Midterm Exam

CMSY-217, Spring 2014

Section 1. Circle the letter of the best answer for each question:

1. How may a recursive Java method be called?
   (a) by itself
   (b) directly
   (c) indirectly through another method
   (d) All of the above
2. What is the runtime efficiency of the `binarySearch` method in the `Arrays` class?
   (a) $O(1)$
   (b) $O(\log n)$
   (c) $O(n)$
   (d) $O(n^2)$
3. The `List` interface is a subinterface of which interface?
   (a) `Collection`
   (b) `Collections`
   (c) `Map`
   (d) `Queue`
4. What is the name of the process by which the Java complier replaces generic type parameters and arguments within a class or method?
   (a) boxing
   (b) deletion
   (c) erasure
   (d) promotion
5. What type of data structure is the `Stack` class?
   (a) first-in-first-out (FIFO)
   (b) first-in-done-out (FIDO)
   (c) last-in-first-out (LIFO)
   (d) last-in-last-out (LILO)

6. Where is the origin of the Java Graphics 2D API coordinate system located on the screen?
   (a) upper left
   (b) upper right
   (c) lower left
   (d) lower right
7. Which of the following is *not* a subclass of the `Number` class?
   (a) `Boolean`
   (b) `Double`
   (c) `Integer`
   (d) `Long`
8. For Homework 3, the `UserInterface` class is a direct subclass of which class?
   (a) `FlowLayout`
   (b) `JFrame`
   (c) `JPanel`
   (d) `Object`
9. In the JVM, the current method executing is always the method whose activation record is:
   (a) at the bottom of the runtime stack.
   (b) at the top of the runtime stack
   (c) never placed on the runtime stack.
   (d) second from the top of the runtime stack, just below the record for the previous method call.
10. What is the runtime efficiency of the Merge Sort algorithm presented in the textbook?
    (a) $O(1)$
    (b) $O(n)$
    (c) $O(n \log n)$
    (d) $O(n^2)$
11. Which interface requires the `compareTo` method to be implemented?
    (a) `Comparable`
    (b) `Enumerable`
    (c) `Orderable`
    (d) `Tractable`

12. If the upper bound of a generic class is an interface, the Java keyword used to specify it is:

    (a) `bounds`

    (b) `extends`

    (c) `implements`

    (d) `limits`

13. The `LinkedList` class can be used to implement which of the following custom data structures?

    (a) stack

    (b) queue

    (c) double-ended queue

    (d) all of the above

14. Which of the following is equivalent to the constant `Color.GREEN`?

    (a) `new Color(255,0,0);`

    (b) `new Color(0,255,0);`

    (c) `new Color(0,0,255);`

    (d) `new Color(255,255,0);`

15. A benefit of generic collections is

    (a) compile-time checking

    (b) an explicit cast is not required when removing items

    (c) runtime safety

    (d) all of the above

16. What interface is designed to provide an alternative to the natural ordering of a collection?

    (a) `Comparable`

    (b) `Comparator`

    (c) `OrderAlernator`

    (d) `Quantifiable`

17. The recursive method shown below is a Java implementation of which of the following?

```
public static int recursiveMethod(int n)
{
   if (n == 0)
      return 1;
   else
      return n * recursiveMethod(n-1);
}
```

(a) Factorial

(b) Fibonacci

(c) Fractals

(d) Towers of Hanoi

18. The methods shown below are a Java implementation of which of the following?

```
public static void someSort(int a[])
{
   int i, j, smallestIndex;

   for (i=0; i < a.length - 1; i++)
   {
      smallestIndex = i;
      for (j = i + 1; j < a.length; j++)
      {
         if (a[j] < a[smallestIndex]) smallestIndex = j;
      }
      swap(a,i,smallestIndex);
   }
}

private static void swap(int a[], int i, int j)
{
   int temp = a[i];
   a[i] = a[j];
   a[j] = temp;
}
```

(a) Bubble Sort

(b) Insertion Sort

(c) Merge Sort

(d) Selection Sort

19. Provided that an instance of the `Stack<Character>` class called `stack` is in scope, what output is produced by the `doSomething` method given the input argument `"Stack Test"`?

```
public static void doSomething(String s)
{
   for (int i=0; i < s.length(); i++)
   {
      stack.push(s.charAt(i));
   }

   while(!stack.isEmpty())
   {
      System.out.print(stack.pop());
   }

   System.out.println();
}
```

   (a) `Stack Test`

   (b) `tesT kcatS`

   (c) No output is produced

   (d) An exception is thrown

20. A self-referential class in Java has an instance variable which is a reference to what?

   (a) another object of the same type

   (b) itself

   (c) the data of another object of the same type

   (d) None of the above

21. For the custom generic list class we studied, which statment will make all elements of the list eligible for garbage collection?

   (a) `first = null;`

   (b) `last = null;`

   (c) `first = last = null;`

   (d) None of the above

22. When obtaining a graphics context, the first line of code in the overriden method should do what?

    (a) call the superclass version of the overriden method

    (b) call the constructor of the `Graphics` class

    (c) call the `repaint` method

    (d) None of the above

23. What advantage does the use of generic collections provide over using raw collection types?

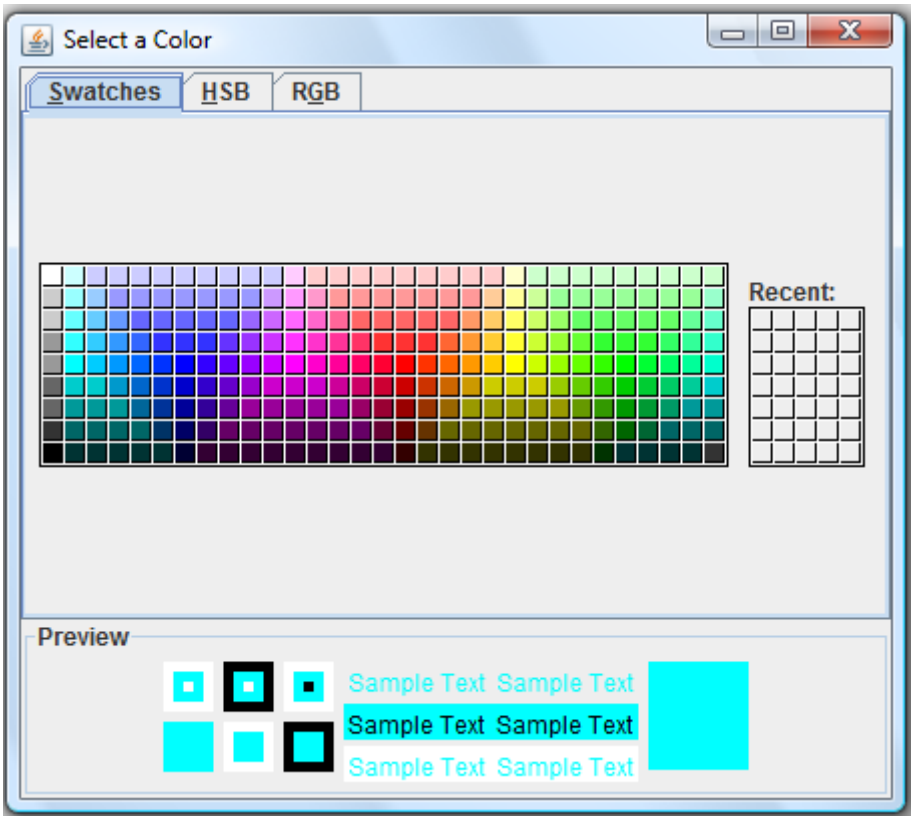
    (a) compile-time checking

    (b) no need for an explicit cast when returning collection elements

    (c) All of the above

    (d) None of the above

24. What is the name of the Java class shown here?



    (a) `JColorChooser`

    (b) `JColorDialog`

    (c) `JColorPane`

    (d) `JColorSwingSet`

25. Given the following method, what is the the return value for the method call `compute(7)`?

```
public static int compute(int n)
{
   if (n == 0)
      return 0;
   else if (n == 1)
      return 1;
   else
      return compute(n-1) + compute(n-2);
}
```

(a) 8

(b) 13

(c) 21

(d) 34

26. Suppose the array `[40, 17, 45, 82, 62, 32, 30, 44, 93, 10]` is passed to the method below to perform an insertion sort. What are the contents of the array after the first iteration of the `for` loop?

```
public static void insertionSort(int[] data)
{
   int insert;

   for (int next = 1; next < data.length; next++)
   {
      insert = data[next];

      int moveItem = next;

      while (moveItem > 0 && data[moveItem - 1] > insert)
      {
         data[moveItem] = data[moveItem - 1];
         moveItem--;
      }

      data[moveItem] = insert;
   }
}
```

(a) `[10, 17, 45, 82, 62, 32, 30, 44, 93, 40]`

(b) `[17, 40, 45, 82, 62, 32, 30, 44, 93, 10]`

(c) `[17, 40, 45, 62, 32, 30, 44, 82, 10, 93]`

(d) `[10, 17, 30, 32, 40, 44, 45, 62, 82, 10]`

27. Consider the following code segment.

```
ArrayList<String> list = new ArrayList<String>();

list.add("P");
list.add("Q");
list.add("R");
list.set(2, "s");
list.add(2, "T");
list.add("u");
System.out.println(list);
```

What is printed as a result of executing the code segment?

(a) `[P, Q, R, s, T]`

(b) `[P, Q, s, T, u]`

(c) `[P, Q, T, s, u]`

(d) `[P, T, Q, s, u]`

(e) `[P, T, s, R, u]`

28. What is the output if you compile and execute the following Java application?

```
import java.util.*;

public class BarSort
{
   public static void main(String args[])
   {
      Number a[] = {3, 1, 4, 6, 5, 2, 0};
      barSort(a);
      System.out.println(Arrays.toString(a));
   }

   public static <T> void barSort(T[] a)
   {
      Arrays.sort(a);
   }

   public static void barSort(Integer[] a)
   {
      Arrays.sort(a, Collections.reverseOrder());
   }
}
```

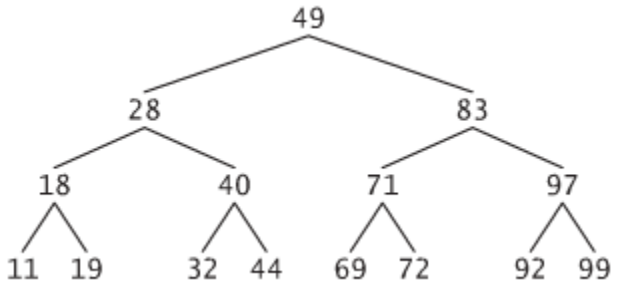
(a) `[Ljava.lang.Integer;@3e25a5`

(b) `[0, 1, 2, 3, 4, 5, 6]`

(c) `[6, 5, 4, 3, 2, 1, 0]`

(d) Compilation fails.

29. A binary search tree is constructed using a generic self-referential tree node class. Fifteen nodes are added and the tree can be represented visually by the following figure



If the following recursive method is called on the root node of the tree, what is the output?

```
public static <E> void traverse(TreeNode<E> node)
{
   if (node.getLeft() != null) traverse(node.getLeft());
   if (node.getRight() != null) traverse(node.getRight());
   System.out.print(node.getData() + " ");
}
```

(a) `49 28 18 11 19 40 32 44 83 71 69 72 97 92 99`

(b) `11 18 19 28 32 40 44 49 69 71 72 83 92 97 99`

(c) `11 19 18 32 44 40 28 69 72 71 92 99 97 83 49`

(d) `49 28 83 18 40 71 97 11 19 32 44 69 72 92 99`

30. What is the output when the following `main` method is compiled and run?

```
public static void main(String args[])
{
   Integer a[] = {3, 1, 4, 1, 5, 9, 2};
   List<Integer> list = new LinkedList<Integer>(Arrays.asList(a));
   list.remove(2);
   System.out.println(list);
}
```

(a) `[3, 1, 4, 1, 5, 9]`

(b) `[3, 1, 1, 5, 9, 2]`

(c) Compilation fails.

(d) An exception is thrown at runtime.

31. Which of the following is *not* a subinterface of the `Collection` interface?

    (a) `List`

    (b) `Map`

    (c) `Queue`

    (d) `Set`

32. Which of the following classes does not implement a generic `Comparable` interface?

    (a) `Arrays`

    (b) `Character`

    (c) `Integer`

    (d) `String`

33. When implementing a Java program program to compute factorials, which types were used in the example code to compute and store the results?

    (a) `float`

    (b) `double`

    (c) `BigDecimal`

    (d) None of the above

34. Which of the following iterative sorting algorithms did we study and implement in Java?

    (a) bubble sort

    (b) selection sort

    (c) Both A and B

    (d) Neither A nor B

35. What is the name of the process by which Java can automatically convert type-wrapper objects to primitive values?

    (a) autoboxing

    (b) auto-unboxing

    (c) closure

    (d) erasure

36. Which type of classes and methods enable you to specify a set of related classes and methods with a single declaration?

    (a) abstract

    (b) generic

    (c) overloaded

    (d) overriden

37. Since the stack is a constrained version of another data structure, stacks may be implemented using classes that implement which one of the following interfaces?

    (a) `Set<E>`

    (b) `List<E>`

    (c) `Queue<E>`

    (d) `Map<K,V>`

38. Which of the following methods does the Java Graphics API provide to display text on the screen?

    (a) `drawString`

    (b) `formatString`

    (c) `printString`

    (d) `writeString`

39. For Homework 1, what was the name of the recursive method implemented in the `QuickSort` class?

    (a) `binarySearch`

    (b) `merge`

    (c) `partition`

    (d) `sort`

40. When writing an application that uses the `Graphics` API, you may obtain a graphics context by overriding which method of the `JPanel` class?

    (a) `drawComponent`

    (b) `repaintComponent`

    (c) `mainComponent`

    (d) `paintComponent`